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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/550,804

09/22/2005

Un-Gyu Paik

3576-013

3980

20575

7590

06/27/2008

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EXAMINER

HOBAN, MATTHEW E

ART UNIT

PAPER NUMBER

1793

MAIL DATE

DELIVERY MODE

06/27/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/550,804	PAIK ET AL.	
	Examiner	Art Unit	
	Matthew E. Hoban	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 May 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,12-14 and 16-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,12-14 and 16-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
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| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>3/7/2008 & 5/1/2008</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Status

Claims 1, 3, 12-14, 16-17, and 19-25 are pending and presented for examination

Claims 2, 4-11, 15 and 18 were cancelled previously by applicant.

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
2. Claims 1, 12, 13, and 16, 17, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akahori et al in European Patent No. 1,148,538 A1 in view of Holty in 3945843.
1. The instant claims 1 is drawn to a CMP abrasive comprising a ceria slurry and a chemical additive having two or more functional groups which is created by mixing and synthesizing a polymeric molecule and a monomer. The ceria slurry of the above abrasive comprises ceria powder, water, and a negative-ion—based polymeric compound and conforms to a Newtonian viscosity behavior.
2. Akahori et al teach a CMP abrasive comprising a cerium oxide slurry containing cerium oxide particles, a dispersant and water, as well as a liquid additive containing a dispersant and water (See page 3, lines 10 to 14). The abrasive has several embodiments which are exemplified in Table 1-1. In this table it can be seen that the cerium oxide slurry and liquid additive are present, where the liquid additive comprises a

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copolymer of an acrylic acid polymer, which is synthesized to include methyl acrylate as a monomer. This copolymer has two or more functional groups and is then mixed with the cerium slurry to create the final CMP abrasive. The cerium slurry of Akahori is prepared by several different means, which are exemplified in preparation methods 3, 4, and 5 on page 7. In all of these embodiments an acrylic acid copolymer was synthesized and used as the dispersant, where the acrylic acid copolymer is an anionic polymeric compound. It is stated by Akahori that the amount of the dispersant in the slurry relative to the ceria can be any amount between .01 and 2 wt% relative to 100 parts by weight of the ceria. This range of compositions shares an endpoint with the range seen in the instant claims and thus anticipates the claims. One of ordinary skill in the art could select from the overlapping portion of the ranges, ie 2 wt% of the copolymer, and arrive at the instantly claimed invention.

3. As stated previously, the chemical additive of Akahori is the same copolymer as is used in the dispersant ie an acrylic acid, methyl acrylate copolymer. This chemical is dissolved in water as stated in Examples 1-10 to reach the concentrations found in table 1-1. The chemical is synthesized. Although, Akahori does not teach a synthesis for this chemical, it was still synthesized by the author or by an outside source. Such copolymers do not exist in a pure state naturally. Synthesis of polyacrylic acid/methyl acrylate copolymers are known in the art and taught for example by Holty (See paragraph 3 of the "Invention" section). So, although Akahori does not directly synthesize, the copolymer is none the less synthetic. The chemical additive which is a copolymer of methyl acrylate and PAA, would include the carboxyl functionality of PAA

and the ester functionality of the methyl acrylate, therefore having two different functional groups. Furthermore, in the broadest interpretation of the claims the copolymer of the claims the chemical additive must include two or more functional groups. A polyacrylic acid has one carboxylate functional group on each monomer, therefore a polyacrylic acid must have at least two or more carboxylate groups. Seeing that the atomic weight of the polymer is 10,000 amu, the copolymer must have 100's of carboxylate groups.

4. **The instant claims 12, 13, and 16, 17, 19** are drawn to a method of manufacturing a CMP abrasive. This is accomplished by providing a ceria slurry, manufacturing a chemical additive having two or more functional groups by mixing and synthesizing a polymeric molecule and a monomer in a reactor, and finally mixing said slurry and said chemical additive. Synthesis of polyacrylic acid/methyl acrylate copolymers are known in the art and taught for example by Holty (See paragraph 3 of the "Invention" section). So, although Akahori does not directly synthesize, the copolymer is none the less synthetic. The ceria slurry of the above mixture also has several steps, which are used in the process of its manufacture, including manufacturing ceria by solid-phase synthesis, mixing the ceria with water, milling in a high energy attrition mill, dispersing the milled resultant with a high pressure dispersion apparatus, and dispersion stabilizing said dispersed resultant by adding a negative-ion based polymeric compound, where the negative ion based polymeric compound is present in an amount of from .0001 to 10 wt%. Following dispersion, the ceria slurry is finally filtered to remove and large particles with a filter. The step of manufacturing the

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chemical additive also has a few more steps and limitations. After its synthesis, further solvent is added to the chemical additive until the chemical additive is .03 to 10 wt% of the solution. Furthermore, the chemical additive should have a molecular weight of 2,000 to 1,000,000 amu.

5. Akahori et al teach a method of manufacturing a CMP abrasive in several steps. The process of making an abrasive, which is of particular interest is outlined in Preparations 1, 3 and the final product Example 1. The process begins by creating the ceria powder. This is done by burning cerium carbonate in a platinum vessel at a temperature of 700 Celsius, which is a solid phase process of creating cerium oxide (Relevant to Claim 13{step a}). The fabricated cerium oxide powder is then mixed with deionized water and the particle size is reduced through a horizontal wet ultrafine dispersing-pulverizer. A pulverizer is the functional equivalent of an attrition mill as both decrease the particle size of powders in an aqueous environment. A pulverizer does however reduce particle size through attrition, which is defined as physical wear (Relevant to Claim 13{steps b and c}).

6. Akahori then creates a slurry with the ceria by a process outlined in Preparation 3. In this step 125g of the ceria particles of the above preparation are mixed with 3g of a 40-wt% aqueous solution of an ammonium salt of a polyacrylic acid copolymer as well as 2372g of water. The polyacrylic acid copolymer is a negative ion based polymeric compound and comprises approximately 1.2 wt% of the slurry based on 100 parts of the cerium oxide (Relevant to claims 13{e} and 15). The mixture is then dispersed using an ultrasonic mixer with stirring. The use of an ultrasonic mixer in place

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of a high pressure dispersion apparatus is a substitution that is not novel and well within the capabilities of one of ordinary skill in the art. Both pieces of equipment perform the same purpose of dispersing a powder in an aqueous solution with the same ultimate result and are thus functional equivalents (Relevant to claim 13{d}). Furthermore, the fact that Akahori adds negative ion based polymeric compound before dispersion in a high pressure dispersion apparatus does not offer patentable distinction to the instant claims. The order in which these steps were performed yields the same well dispersed solution and do not provide unexpected results. Furthermore, the instant claims do not even require a particular order to the steps. Following dispersion, the slurry is filtered with a .8 micron filter.

7. Akahori then creates a CMP abrasive in Example 1. This is accomplished by using the ceria slurry above and a liquid additive (chemical additive). The chemical additive is a premanufactured polyacrylic acid polymer synthesized with methyl acrylate monomers (this has two or more functional groups) (Relevant to Claim 12 and 15). Although this chemical seems to not be made by Akahori, it was synthesized in a reactor by a company, who sells such polymers. Synthesis of polyacrylic acid/methyl acrylate copolymers are known in the art and taught for example by Holty (See paragraph 3 of the "Invention" section). So, although Akahori does not directly synthesize, the copolymer is none the less synthetic. There is no other way to create copolymers with good purity and engineered properties. It is quite clear that these polymers could not occur naturally. In table 1 it can be seen that this chemical additive is diluted with water to a concentration of 1% and has a molecular weight of 10,000

(Relevant to claim 17-19). The ceria slurry and liquid additive are added together in equal portions of 500g to create the final CMP abrasive (Relevant to Claim 12).

8.

9. **Claims 3 and 14** are rejected under 35 U.S.C. 103(a) as being unpatentable over Akahori in EP 1148538 in view of Holty in 3945843 and further in view of Kido et al in EP 1,061,111.

10. Please review the above 103 rejection to discern the breadth of the instant claims as well as the teaching of Akahori in relation to the claims.

11. The difference between the instant claims 3 and 14 and the teachings of Akahori is the fact that Akahori uses a poly acrylic acid copolymer as a negative ion based polymer dispersant in the ceria slurry, while the instant claims use several other species of polymer, not inclusive of poly acrylic acid.

12. This difference is resolved by Kido who teaches the use of polymethacrylic acid in the ceria slurry, where the methacrylic acid performs the same function as the polyacrylic acid of Akahori. This can be seen in Example 10 of Kido, and the results found in Table 2. The results from this experiment show that polymethacrylic has a selection ratio relatively the same as acrylic acid, which was used by Akahori. Furthermore, methacrylic acid has a 4% faster polishing rate. This means that methacrylic acid can perform at the same quality as acrylic acid, but at a slightly faster rate. This alone gives good motivation to use methacrylic acid in the invention of Akahori. This substitution could be done in light of the fact that these two chemicals are

shown to be functional equivalents by Kido and one of ordinary skill in the art would have been able to recognize this and combine these two teachings. This teaching could be incorporated into both the product as in claim 3, and also the process of manufacturing in claim 13.

13. **Claims 20-24** rejected under 35 U.S.C. 103(a) as being unpatentable over Akahori et al in EP 1148538 in view of Holty in 3945843.

14. Please review the above 103 rejection to discern the breadth of the instant claims as well as the teaching of Akahori in relation to the claims.

15. The difference between the instant claims 20-24 and the explicit examples as taught by Akahori is the fact that Akahori does not teach the exact chemical additive as recited by claims 20 and 22. This chemical additive of the instant claims includes a compound that is a polymeric acrylic acid or alkyl methacrylate synthesized and reacted with a monomer of acrylamide, methacrylamide, ethyl-methacrylamide, vinylpyridine, and vinylpyrrolidone. The chemical additive containing this compound is then added to the ceria slurry at a ratio of 1:1.

16. The difference between Akahori and the instant claims is actually resolved by the rest of Akahori's disclosure, especially at page 4, paragraph 20. Akahori states that several different polymer dispersants are suitable for use in the invention mentioning that "copolymers of an unsaturated carboxylic acid, such as **acrylic acid**, methacrylic acid, or maleic acid, with a copolymerizable monomer, for example an alkyl acrylate, such as **methyl acrylate** or **ethyl acrylate**, a hydroxyalkyl acrylate, such as hydroxyethyl acrylate, an alkyl methacrylate, such as methyl methacrylate or **ethyl**

methacrylate, a hydroxyalkyl methacrylate such as hydroxyethyl methacrylate vinyl acetate or vinyl alcohol and ammonium salts or **amine** salts of the copolymers.

[emphasis added]" Specifically a chemical additive having a polymeric group being PAA and the monomer being acrylamide or ethyl-methacrylamide falls under the group as disclosed by Akahori. Akahori's disclosure teaches that a large group of simple carboxylic acid polymers, complexed with acrylamides and similar compounds are useful in the invention, and a polyacrylic acid copolymerized with these monomers would be a graft copolymer based on the functionalities of the two constituents as well as the fact that the acrylamides are provided as monomers with a polymeric acrylic acid. This renders any other use of a simple well known compound of this nature to be an obvious variant to try based on Akahori's disclosure. More specifically a PAA polymer complexed with ethyl-methacrylamide or acrylamide would be even more obvious based on the fact that this combination was explicitly mentioned. Furthermore, the ratio at which the chemical additive and the ceria slurry are mixed is integral in all of Akahori's explicit examples, where 500g of the ceria slurry is mixed with 500g of the chemical additive. The optimal mixture ratio of 1:1 Between these two elements is well known. Therefore, upon reading Akahori's disclosure it would have been obvious to one of ordinary skill in the art to experiment with and try different polymers based on acrylate polymers and acrylamide monomers. Akahori states that this class of material is functionally equivalent to those used in his explicit examples and one of ordinary skill in the art would have recognized this and would have had a reasonable expectation of success.

3. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Akahori et al in European Patent No. 1,148,538 A1 in view of Holty in 3945843 as applied to claim 1 above, and further in view of Yoshida et al in 6,343,976.

4. Please review the above 103 rejection of claim 1 to discern the breadth of the instant claims as well as the teaching of Akahori in relation to the claims. It is noted in the previous rejection that Akahori teaches the use of up to 2% wt dispersant relative to the ceria particles in the ceria slurry.

5. Akahori does not teach using greater than 2% wt dispersant relative to the ceria particles in the ceria slurry.

6. However, Yoshida teaches a similar ceria slurry that is later used for CMP. The ceria slurry of Yoshida is defined in columns 3, line 55 through column 4, line 37.

Yoshida teaches that a cerium oxide slurry can be reated from cerium oxide particles, water, and a dispersant, where the dispersant can be present in an amount from .01 to 5 wt% relative to 100 parts by weight of the cerium oxide particles. Preferred dispersants include a copolymer of ammonium polyacrylate with methyl acrylate.

7. It would be obvious to use the greater range of dispersants in Yoshida inn the invention of Akahori. Akahori and Yoshida use the same dispersant with the same particles being dispersed. By going towards the upper end of the range of Yoshida, one would get the positive effect of a dispersion that was less likely to settle, while still avoiding reagglomeration of the particles (See Lines 33-37 of Column 4). So by adding an amount of dispersant closer to 5 wt% one would have a solution that would not settle

as quickly as a solution with 2 wt% dispersant, leading to a better product with a longer shelf life. This improvement would give obvious motivation to one of ordinary skill in the art since a better product would be produced. Therefore the combination of these two references would be obvious to one of ordinary skill in the art and clearly motivated. Furthermore, based on the disclosure of Akahori, the combination of these teachings would lead one to have a reasonable expectation of success in this endeavour.

Response to Arguments

8. Applicant's arguments filed 5/01/2008 have been fully considered but they are not persuasive. Applicant arguments in paragraph 1, page 6, that Akahori does not teach a range of dispersant from 2-10 wt%, but Akahori does teach from .01-2 wt%. Therefore, Akahori teaches 2 wt% dispersant, which reads on the instant claim 1. In paragraph 2, page 6, applicant argues that Akahori does not mix the chemical additive with a solvent after it is synthesized. The copolymer is synthesized prior to acquisition by Akahori and is then mixed with water, See Examples 1-10 of page 7. Applicant argues in paragraph 5 on the same page that Akahori discloses a chemical additive of acrylic acid and methyl acrylate and not a copolymer of these two chemicals. This assertion is incorrect. In Examples 1-10 on page 7 Akahori states that " the liquid additive....was prepared by dissolving in deionized water a predetermined amount of the same dispersant as that used in the cerium oxide slurry." This slurry can be found in Preparation 3, where Akahori states "1.3g of a 40 wt% aqueous solution of an ammonium salt of polyacrylic acid copolymer, which was a 3: copolymerization product

of acrylic acid and methyl acrylate". Therefore the liquid additive of Examples 1-10 must refer to this same copolymer. Applicant further argues that this copolymer would not have two or more functional groups, but this is clearly misguided since a copolymer of the given molecular weight would have hundreds of functional groups, which are both ester and carboxyl functionalities. Therefore, the chemical additive is clearly taught as is the dispersant. For the above reasons the rejection of the claims based on the art of record is maintained. The objection to the claims based on semantics is withdrawn in light of the fact that the problems of record have been ameliorated.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Hoban whose telephone number is (571)

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270-3585. The examiner can normally be reached on Monday - Friday from 7:30 AM to 5 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jerry Lorengo can be reached on (571) 272-1233. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jerry A Lorengo/
Supervisory Patent Examiner, Art Unit 1793

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